TECHNICAL NOTES

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE

ENGINEERING #5 **SPOKANE, WASHINGTON**

"GUIDANCE FOR GEOLOGIC SITE EXPLORATIONS OF WASTE STORAGE PONDS"

I. PURPOSE

The purpose of the geologic site exploration is to identify the engineering properties of the soil and the pollution potential of the site.

II. SCOPE

This guidance applies to excavated ponds and structure class a dams with less than 35 feet of fill.

III. SITE DESCRIPTION

The site shall be explored through the excavation of two (2) or more test pits. Preliminary borings may be used to help identify where to place the test pits, but soil borings alone are insufficient for geologic site explorations. Excavation of test pits shall meet NEPA requirements and shall comply with OSHA Construction Industry Standards (29 CFR, Part 1926, Subpart P – Excavations).

If the borings or test pits indicate that the site presents severe limitations towards construction and/or operation of the pond (e.g. you encounter saturated sands, organic soils or karst features), notify the landowner and discuss the possibility of relocating the waste storage facility before continuing.

- For excavated ponds, test pits should extend to a depth at least two (2) feet below the planned excavated bottom elevation prior to the addition of any liner.

  The number of test pits per site will depend on the complexity of the soils and the topography of the site. At least two (2) pits should be excavated and logged for sites up to ½ acre and a minimum of one (1) additional pit excavated and logged for each ½ acre increase in size. For complex or environmentally sensitive sites, additional pits should be explored based on the best professional judgement of the investigator. (AWMFH, Chapter 7)

- For embankment ponds, additional test pits shall be excavated and logged along the proposed embankment centerline and shall extend to a depth at least equal to the height of the fill or to the depth of refusal. For fill heights greater than 15 feet consider the use of a drill rig for drilling and logging the foundation materials and the acquisition, if possible, of undisturbed samples for consolidation tests.

  A minimum of four (4) test pits should be excavated and logged for embankment lengths less than 100 feet. For embankment lengths greater than 100 feet, excavate and log four (4) test pits or one per 100 feet whichever is greater. (AWMFH, Chapter 7)

The soil profile of each test pit shall be described according to ASTM-D2488 (Visual-Manual Procedure) and recorded using SCS-ENG-533 Log of Test Hole or similar form from the ground surface to the bottom of the pit. The log of the test pit should include the following (AWMFH, Chapter 7):

- Horizontal location and surface elevation of the test pit.
- Group name and USCS Symbol according to ASTM-D2488 for each soil interval.
- Depth in the pit where the USCS class changes. Intervals with a thickness of three (3) inches or less shall be described as an inclusion in the surrounding materials.
- Depth of the water table observed in the pit and the seasonal high water table. Document the indicators used to identify these features.
- Parent material. If bedrock is encountered, the location and type of rock shall also be logged.
- Other characteristics of the soil that could affect the construction process and the pollution potential of the site. Such as:

    - Macropores from animal burrows, plant roots, soil structure, fractures in dense till, and other sources that offer a preferred pathway for contaminant movement if the seal of the liner is broken.
    - Soils composed primarily of volcanic ash (i.e. Andisols) that may have different physical and chemical properties if they are allowed to dry.
    - Sidewall or cutbank caving (collapse of unstable, saturated sands) that could affect construction.

IV. SAMPLING

Samples will be collected from the identified borrow area. If no suitable materials are found from the proposed site of the waste storage facility, work with the landowner to identify a borrow area. Test pits of off-site borrow areas for embankments and/or compacted soil liners shall also be excavated and logged as described above.

If borrow is obtained from an outside source the landowner shall provide the location of the borrow source for soil mechanics testing or a soil mechanics report that meets the minimum requirements for testing as described in Section III of this guidance document. Upon identifying a suitable borrow material, the landowner shall make the appropriate contacts for permission of the NRCS technical representative to verify borrow site material and the estimated quantity available.

Compacted Soil Liner

For ponds where a compacted soil liner is planned, a minimum of one (1) disturbed sample weighing at least 50 pounds should be obtained from the soil interval designated by the NRCS geologist, engineer or soil scientist as borrow for the compacted soil liner.

A 50 pound sample is the minimum required for samples sent to the NRCS Soil Mechanics Lab (Geology Note 5 and personal communication). Check with private labs for their sample size requirements if such facilities are to perform the soil tests.

If more than one interval is identified as potential borrow, separate samples will be obtained from each interval. Samples will be representative of the identified interval(s). Note on the log of the soil profile the depth where the sample was taken (i.e. from 24" to 48") and include this in the description of the test pit.

Soil Amendments/Additives

If soil amendments or additives will be used in construction of the compacted soil liner, you should include a sample of the additive for soil mechanics laboratory testing. Make sure the sample is in the form (e.g. powdered, granular) that will be used during construction. Also, include source location information and any available manufacturer's product specification materials.

Earthen Embankment

For ponds where an earthen embankment is planned, a minimum of one (1) disturbed sample weighing at least 50 pounds should be obtained from the soil interval designated by the NRCS geologist, engineer or soil scientist as borrow for the earthen embankment.

If more than one interval is identified as potential borrow, separate samples will be obtained from each interval. Samples will be representative of the identified interval(s). Note on the log of the soil profile the depth where the sample was taken (i.e. from 24" to 48") and include this in the description of the test pit.

Disturbed soil samples for soil mechanics testing should be placed in heavy-duty plastic bags with a minimum 6-mil thickness. One sample tag shall be placed inside the bag and another attached to the outside. Sample tags shall record:

- Date
- Location (county/state)
- Project name
- Hole number/Sample number
- Sample depth
- Name of person collecting sample
- Funding source (CO-01, EQIP, etc.) for samples sent to the NRCS SML

Sample bags shall be sealed with a tie or staples to preserve the moisture content of the sample. A soil sample list (SCS-ENG-534 List of Soil Samples or similar form) shall be included when samples are shipped to the soil mechanics testing facility.

V. TESTING

Soil samples shall be sent to the NRCS SML or a testing facility that is capable of performing the following tests:

All Samples

- Unified Soil Classification (ASTM-D422 and D2487)
- Standard Proctor Moisture-Density Relationship (ASTM-D698)

Samples for Soil Liners

- Flexible Wall Permeability (ASTM-D5084)

For each sample, the report from the testing facility shall include:

Unified Soil Classification

1. Table of gradation analysis
2. Atterberg Limits (liquid limit and plasticity index)
3. Unified Soil Classification

Standard Proctor Moisture-Density Relationship

4. Graph of moisture-density relationship
5. Maximum dry density
6. Optimum moisture content
7. In-place moisture content

Flexible Wall Permeability

8. Permeability in units of centimeters per second (cm/s)
9. Standard proctor and moisture content for each permeability test

VI. REPORTS

Reports for waste storage pond site explorations shall include a description of the soils observed in the test pits, observed water table elevation, seasonal high water table and other environmental considerations in regard to the pollution potential of the site. The report shall include the following:

1. Site map showing location of existing structures, location and elevation of test pits, location of proposed waste storage facility and additional borrow areas if necessary.
2. Log of each test pit.
3. Copy of the soil mechanics report.
4. Statement of the limitations of the soil materials and site for construction of a waste storage pond.
5. Statement of the environmental sensitivity and suitability of the site for construction of a waste storage pond.
6. Documentation of assumptions and judgements made in the report.
7. Project funding source.

VII. NOTE

This document reflects current national NRCS guidance and policy and is subject to revision.

VIII. REFERENCES

Agricultural Waste Management Field Handbook (AWMFH) Chapter 7 – "Geologic and Ground Water Considerations", National Engineering Handbook Part 651, USDA – Natural Resources Conservation Service, June 1999.

Geology Note 5 – Soil Sample Size Requirements for Soil Mechanics Laboratory Testing, USDA – Natural Resources Conservation Service, November 1991.
National Engineering Manual (NEM) Part 531 Geology, USDA – Natural Resources Conservation Service, November 1999.
National Handbook of Conservation Practices (NHCP) Practice Standard 313 – Waste Storage Facility, USDA – Natural Resources Conservation Service, September 1999.
National Handbook of Conservation Practices (NHCP) Practice Standard 378 – Pond, USDA – Natural Resources Conservation Service, October 1987.

ASTM Standards:
D422 Standard Test Method for Particle-Size Analysis of Soils
D698 Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3(600kN-m/m^3))
D2487 Classification of Soils for Engineering Purposes (Unified Soil Classification System)
D2488 Practice for Description and Identification of Soils (Visual-Manual Procedure)
D5084 Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.